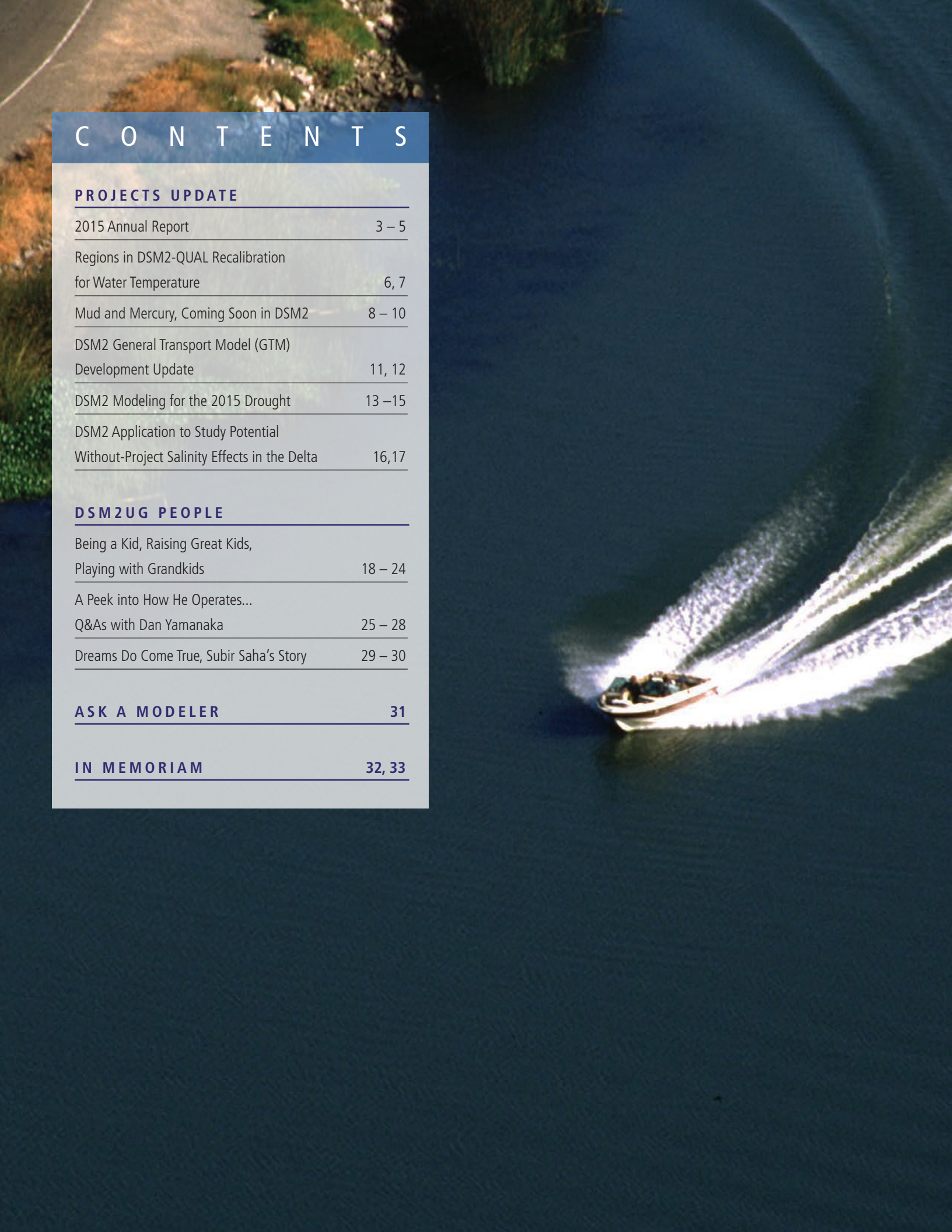
DSM2UG

DELTA SIMULATION MODEL 2 USER GROUP

2015

CALIFORNIA DEPARTMENT OF
WATER RESOURCES

BAY DELTA OFFICE
DELTA MODELING SECTION



CONTENTS

2015 Annual Report

Min Yu, Senior Engineer WR, DWR

The following are brief summaries of modeling work conducted during 2014, which will be presented in the 2015 Annual Report to the State Water Resources Control Board.

Chapter 1 ■ PTM Fish Behavior Development Workshop

This chapter summarizes the Particle Tracking Model (PTM) Fish Behavior Development Workshop held at DWR on January 8, 2015. This workshop was attended by PTM developers from National Marine Fisheries Service (NMFS), U.S. Geological Survey (USGS), and California Department of Water Resources (DWR). The leads for the three agencies were Doug Jackson (NMFS), Russel Perry (USGS), and Xiaochun Wang (DWR).

Chapter 2 ■ New Reservoir Implementation in DSM2 V8.1.3

This chapter describes a modification for the Delta Simulation Model 2 (DSM2) open water areas to include changing bathymetry with elevations. Previously, open water areas were treated as a constant area with a bottom elevation. This change will help to better model Liberty Island in addition to other open water areas in the Delta. The elevation-area-storage curves for reservoirs can be calculated using geographic information system (GIS) tools like ArcMap. The model has been tested and new results have been evaluated.

Chapter 3 ■ Estimating the Impact of Groundwater on Delta Channel Depletions

This chapter describes the study that integrated the consumptive use, hydrodynamics, and water quality models and also calibrated the groundwater supply and Electrical Conductivity together by using the correlation between Delta outflow and EC. With the estimated groundwater contribution, EC, in the summers of the critical and dry years, could be estimated close to the measured field data.

Chapter 4 ■ Modeling Physical Barriers (Gates) as Engineering Solutions to Satisfy NMFS BiOp RPA Action IV.1.3

This chapter provides detailed modeling information on the potential impact on flow, water quality, and water level throughout the Delta of physical barriers (gates) as engineering solutions to deter fish from entering the Delta. The modeling was performed to provide information to support decision-making for engineering solutions to satisfy the National Marine Fisheries Service Biological Opinion Reasonable Prudent Alternative (NMFS-BiOp

RPA) Action IV.1.3 (Action). The Action objective is to prevent emigrating salmonids from entering into the Interior of the Delta and southern Delta, and to reduce exposure to the Central Valley Project (CVP) and State Water Project (SWP) export facilities. Delta Simulation Model II (DSM2) was used to simulate gates on the Delta channels: Georgiana Slough, Head of Old River, Turner Cut, and Columbia Cut. The modeling results have been evaluated for impact analysis of flow, water quality, and water level throughout the Delta.

The Delta Simulation Model II has been widely used for three types of Delta simulations: historical conditions, near- and long-term forecasting, and planning studies.

Chapter 5 ■ Visualizing DSM2 Simulation Results with ArcMap

The Delta Simulation Model II has been widely used for three types of Delta simulations: historical conditions, near- and long-term forecasting, and planning studies. DSM2 simulations have been applied for various purposes. Some examples include forecasting water quality in the Delta and the California Aqueduct system, generating hydrologic information for a permit application, and providing support for litigation. Since DSM2 simulation results can be presented to members of the public coming from various backgrounds , it is vital to present simulation results tailored to meet the needs of different audiences. In the past, the visualization of DSM2 EC results was warmly accepted. Even so, it takes many steps to prepare an animation, and the process relies on a program called Tecplot. Tecplot was fairly uneconomical to purchase, especially considering that Tecplot has been rarely used by other staff in the Bay-Delta Office.

Chapter 6 ■ Rating Clifton Court

With the help of staff at California Department of Water Resources (DWR) Operations and Maintenance (O&M), Delta Field Division (DFD), and North Central Region Office (NCRO), the Delta Modeling Section has developed a new rating for the Clifton Court radial gates — a formula for estimating flow into the forebay based on gate heights and water levels inside and outside the gates. The new rating is suitable for operational and modeling purposes. Clifton Court Forebay is included explicitly in our models, DSM2 and SCHISM. In addition to presenting the new rating, we describe DSM2 modeling experiments that show the role the gates play in the local balance and where modeling error tends to manifest. Although our main results are obtained with detailed gate data and pumping data, we also address situations, such as planning scenarios, where detailed time series of gate heights and exports are not available.

The main potential impact of the work presented in this chapter is on water levels in the forebay, where the Clifton Court gate characterization and modeling practices have an enormous impact on results. There are more minor impacts as well on exterior water levels in the South Delta, on high tide, on water quality, and residence time in the forebay.

Chapter 7 ■ Calibrating the Martinez Boundary Salinity Generator using PEST

Martinez represents the stage-and-salinity boundary and the location for applying the Delta Simulation Model 2 (DSM2). The salinity at this location is estimated using the Net Delta Outflow (NDO) and stage. This chapter presents a re-calibration effort for the Martinez boundary salinity generator, with a mathematically based calibration software named PEST. This new calibration improves the performance of the model by better matching the historical salinity data, particularly at the higher value range. The performance of the current calibration has been a concern of water resources management, especially in the current drought crisis.

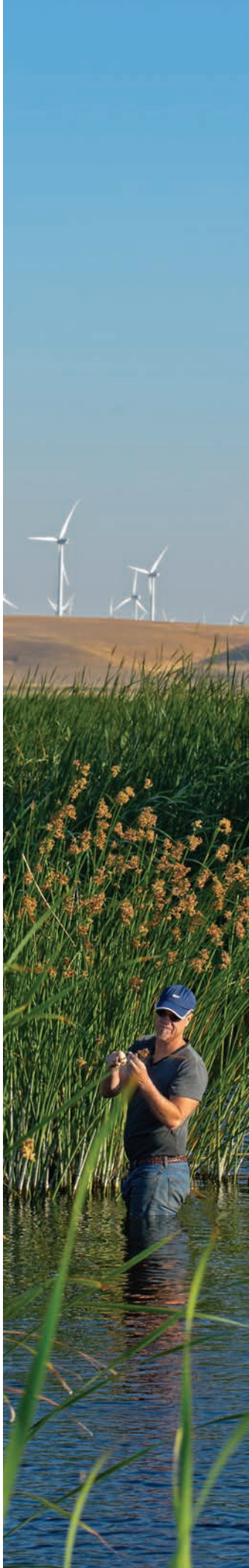
This chapter describes the background of the Martinez boundary salinity generator, explains the methodology and configuration of PEST for model calibration, and presents some preliminary findings.

Chapter 8 ■ Bay-Delta SCHISM Model Developments and Applications

The Bay-Delta SCHISM project is an application of the 3D SCHISM (Semi-Implicit Cross-Scale Hydroscience Integrated System Model) that offers the capability to study cross-scale, multidimensional flow and transport in the Bay-Delta. SCHISM is an open source, 3D computational model derivative from an earlier model, SELFE. We have incorporated into SCHISM practical details needed to model the Bay-Delta, such as agricultural sources and sinks, gates and seasonal gates, and barriers. Work on the model has been collaborative with the Virginia Institute of Marine Science and other users.

The model has been deployed for studies over the full domain of two years by DWR, and we have begun offering institutional support through workshops. The model has also been used as the estuary hydrodynamic component of multidisciplinary collaborations with National Aeronautics and Space Administration (NASA), National Marine Fisheries Service/National Oceanic and Atmospheric Administration (NMFS/NOAA), and San Francisco State University, including the SESAME project, a full life cycle model for fish, and NASA-HICO, a remote sensing and nutrient modeling analysis of human impacts.

Development in the past year has emphasized a public release, drought applications, and algorithm improvements. Progress has been made towards diverse capabilities such as robust flood modeling and temperature calibration. Chapter 8 surveys some of the work, much of which is in progress.



Regions in DSM2-QUAL Recalibration for Water Temperature

Dr. Marianne Guerin, Associate, Resource Management Associates

As noted in previous presentations for the DSM2 User Group, I've been recalibrating the DSM2-QUAL nutrient model for a couple of projects, working with researchers from SFEI and USGS.

The first step in this process is recalibrating the water temperature model – this transport equation can be calculated independently of the other constituents in the nutrient model – on the other hand, most of the equations in the nutrient model depend on the water temperature calculation. My previous nutrient model work used a long term simulation – starting in January, 2000 and ending December, 2008. My current projects extend the end of the simulation period to March, 2012.

Although QUAL is limited to one meteorological region, previous work has shown that at least two meteorological regions are needed for a good Delta-wide simulation of water temperature. For practical purposes, I have been using meteorological data from the CIMIS stations near Lodi – in part because I built upon Hari's previous nutrient model work and he used these stations (he focused on the San Joaquin River and dissolved oxygen concentrations) and in part because the data set there is relatively complete. Because my previous calibration focus was on the Sacramento River, I found that although the Lodi-area meteorological station set worked well for the south Delta and the San Joaquin River, water temperatures in the Sacramento River were too warm in the summer. To correct this regular bias, I found that increasing summer wind speed by a factor of 2.0 (i.e., 2.0*wind speed) gave an acceptable fit for the Sacramento River, although the south Delta and the San Joaquin River were then biased too cold during the summer.

My current projects are Delta-wide – without a regional focus, it was clear that I needed to reconsider my previous wind speed factor. To this end, I updated the meteorology and then ran simulations with the summer wind speed set as follows:

- Base case – no increase in summer wind speed
- Increase summer wind speed by a factor of 1.3
- Increase summer wind speed by a factor of 1.5
- Increase summer wind speed by a factor of 1.6
- Increase summer wind speed by a factor of 2.0

Using a data set of CDEC water temperature data (with clearly bad or suspect data removed), I undertook a residual analysis (Model – data) and calculated several statistical measures to assess model goodness of fit at each data location for each of the simulations. The main statistics I used were:

- Mean of the residual
- Standard deviation of the residual
- Root-mean-square-error
- Percent Bias

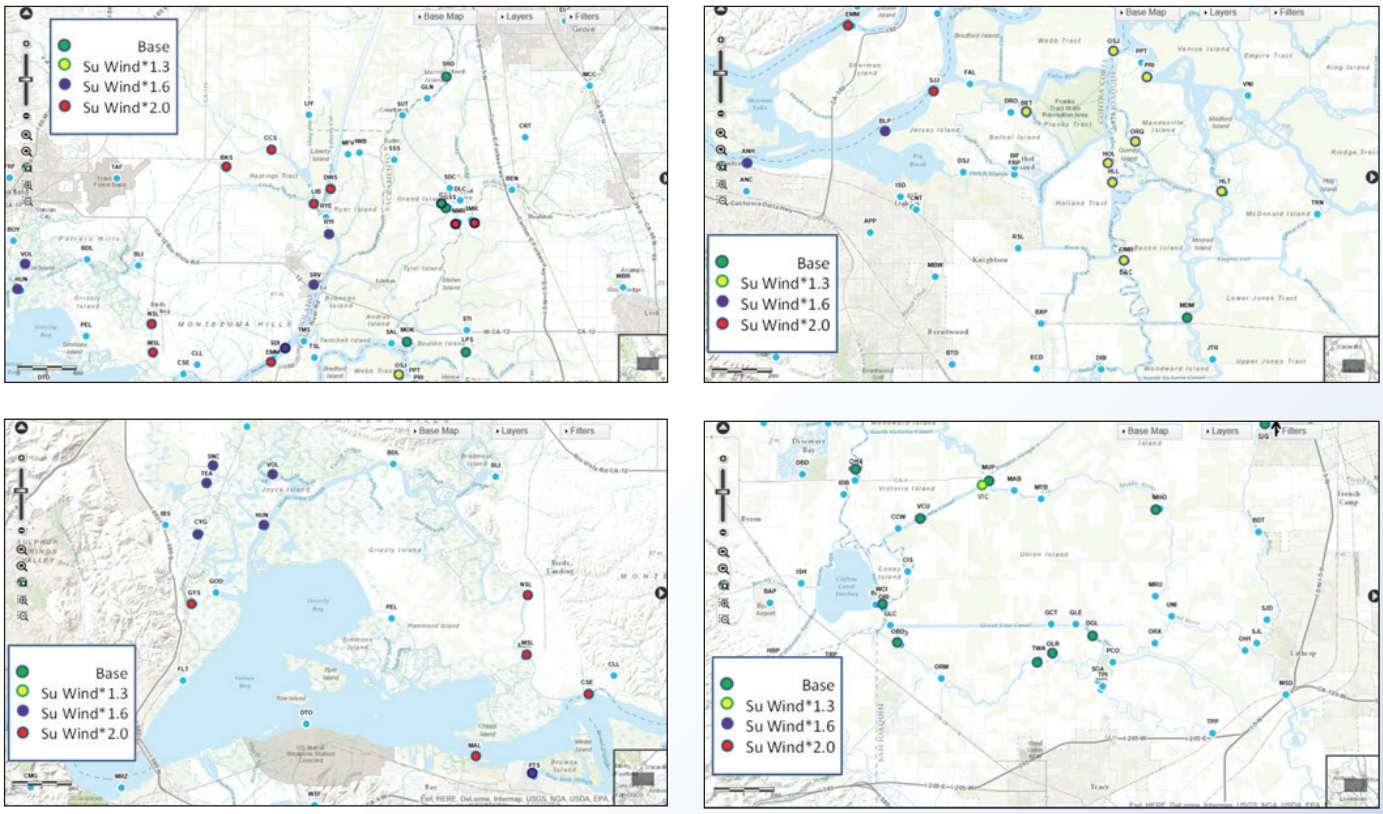
I then categorized locations in the Delta for each

Although QUAL is limited to one meteorological region, previous work has shown that at least two meteorological regions are needed for a good Delta-wide simulation of water temperature.

of the simulations by the minimum of the absolute value of the percent bias. As an aside, I found that typically the other three statistical measures followed the percent bias to indicate which simulation was "the best" out of the five I ran. The simulation increasing summer wind by a factor of 1.5 only minimized the percent bias at one location. The following plots are color-coded to show the spatial distribution of the locations where I calculated water temperature residuals – residuals were not calculated at light blue dot locations. Not surprisingly, the locations where bias was minimized are grouped spatially – so, the green dots show locations were the "best" simulation used the Base Case wind speed, while the locations at the red dots had a minimum bias when summer wind was increased by a factor of 2.0. I will use the simulation with (wind speed)*1.6 in the summer – in this simulation, half of the data locations have a positive bias, and half have a negative bias.

Note: I also ran nutrient models for each of the wind speed simulations – the results were surprising!

Figure 1 | Spatial distribution of the locations where model residuals of Percent Bias (Model – CDEC water temperature data) were minimized for each of the four dominant simulations.



Mud and Mercury, Coming Soon in DSM2

Jamie Anderson, Senior Engineer WR, DWR

As part of the response to the recent Delta Mercury Total Maximum Daily Load (TMDL) provisions, the Delta Simulation Model 2 (DSM2) is being expanded to simulate suspended sediments, bed sediments and mercury.

The model development is a joint project between Department of Water Resources Bay-Delta Office staff and consultants from Reed Harris Environmental Ltd.

The Delta mercury budget that was assessed as part of a multi-year CALFED Delta mercury cycling field study (Stephenson and Bonnema, 2008) shows that the major sources of methyl mercury in the Delta are flow through the Delta and sedimentation (Figure 1). DSM2 provides a solid backbone for simulating transport of constituents through the Delta, but it requires enhancements and expansion to represent the complexity of mercury cycling including (Figure 2):

- replacing the QUAL module with an upgrades General Transport Module that uses a more modern coding structure that is modular and

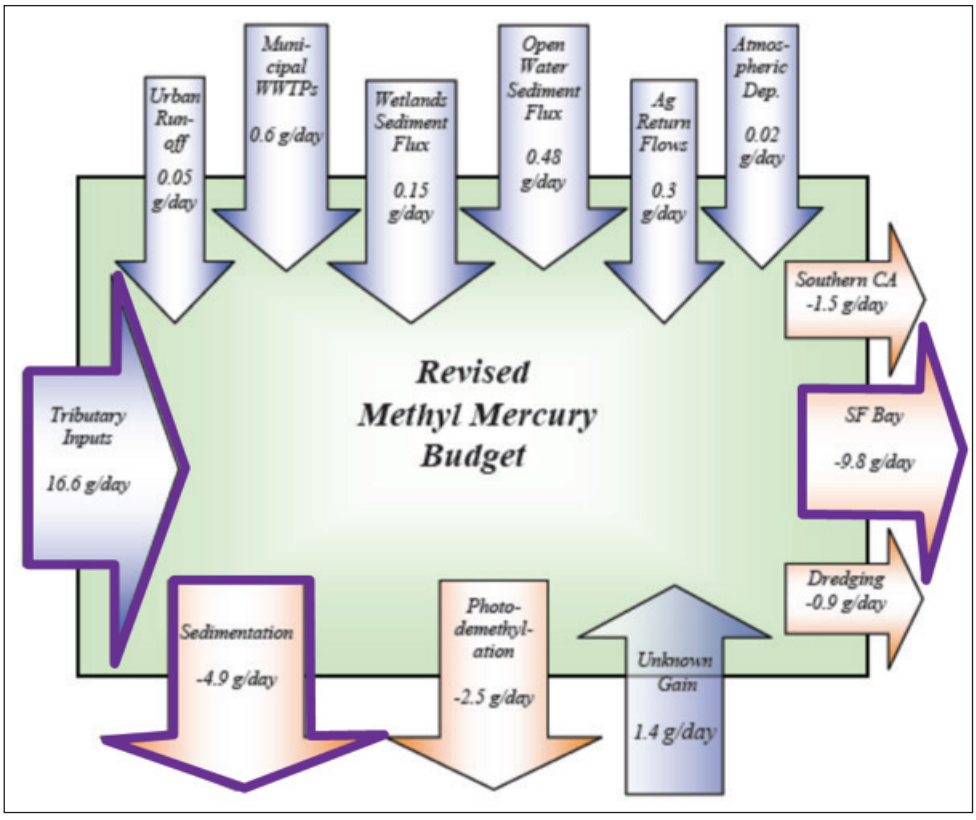


Figure 1 | Delta Mercury Budget with Largest Source and Sinks Highlighted *Source:* Stephenson and Bonnema (2008)Purple highlighting was added to indicate major sources/sinks

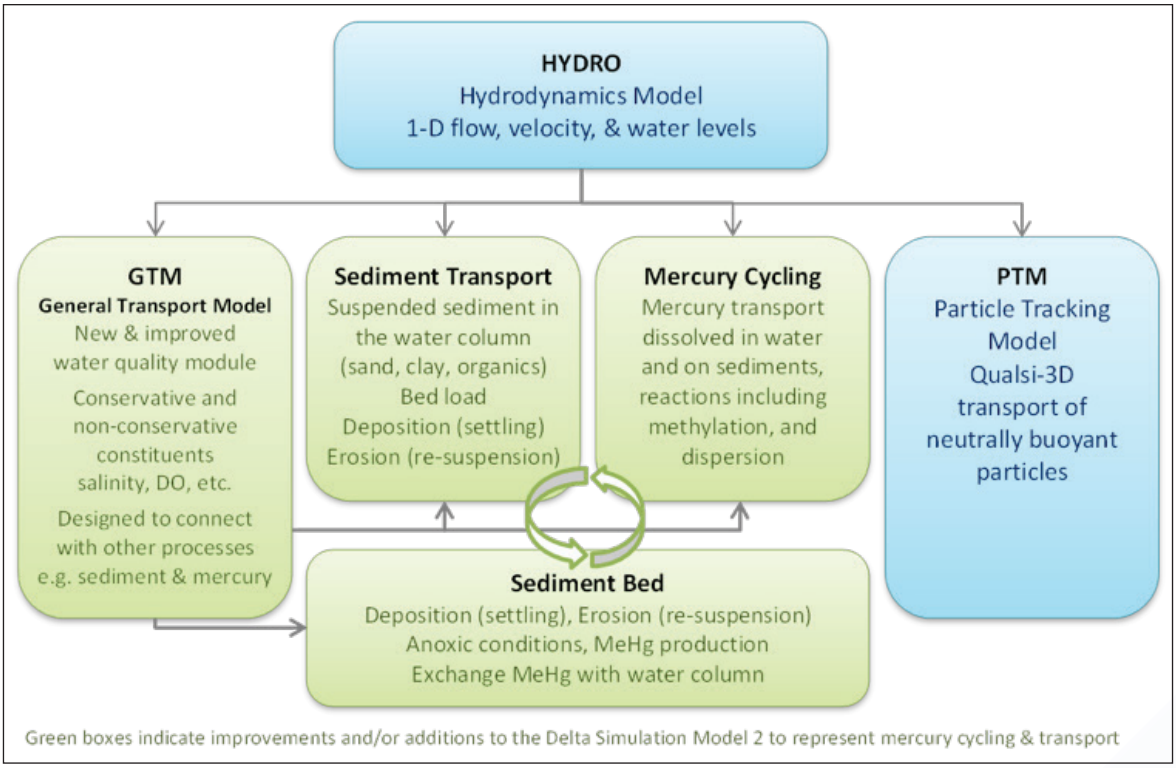


Figure 2
Expansion of the Delta Simulation Model 2 (DSM2) to represent Mercury Cycling and Transport

testable which will facilitate adding complex water quality modules such as those needed to represent mercury cycling (see article on GTM in this newsletter)

- Add modules for suspended sediment, bed sediment and mercury cycling

Key tasks in the Delta mercury model development are summarized in Figure 3, and progress on those tasks is indicated by the colored shading. Current efforts focus on developing and testing the four new modules for DSM2:

- General Transport Module (transport and fate of conservative and non-conservative constituents)
- Suspended Sediment
- Bed Sediment
- Mercury Cycling

Once those modules are completed, they will be integrated into the existing DSM2 model. The integrated model will then be applied to the Delta. Field data will be used to tune the model to represent historically observed conditions in a process called calibration and validation. Once the model is calibrated and validated, it will be evaluated to determine if the model is adequate for scenario analysis to support decision making.

Progress on the model development will be detailed

Mud and Mercury – CONTINUED

in a report to the State Water Resources Control Board this fall.

References

Stephenson and Bonnema (2008). "Task 5.3a. Methylmercury Loss in the Delta Through Particulate Deposition" from Transport, Cycling, and Fate of Mercury and Monomethyl Mercury in the San Francisco Delta and Tributaries: An Integrated Mass Balance Assessment Approach, CALFED Mercury Project Final Report, September 15, 2008.

https://mercury.mlml.calstate.edu/wp-content/uploads/2008/10/16_task5_3a_deposition.pdf

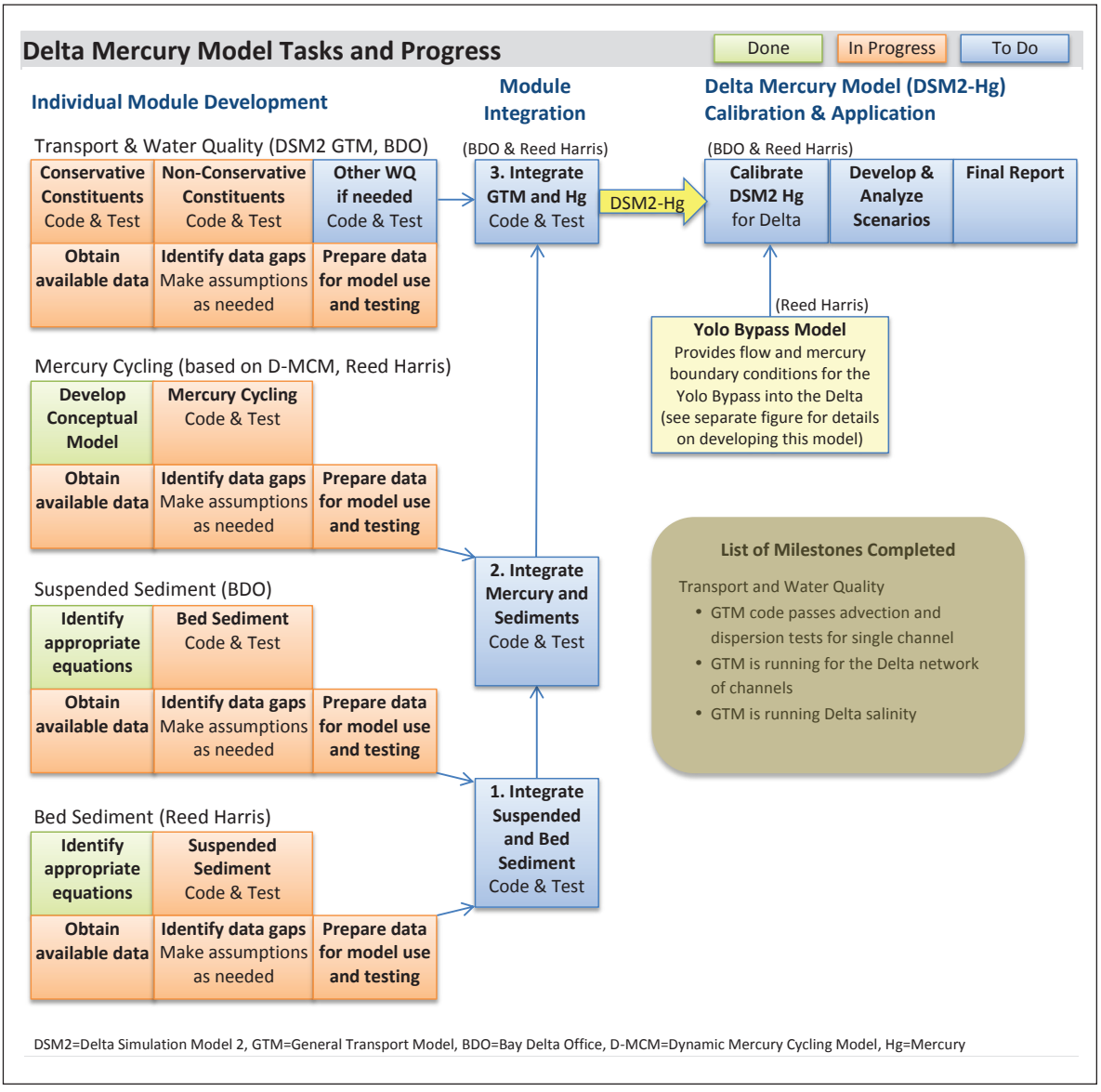


Figure 3
Progress and Key Steps for Development of the Delta Mercury Model

DSM2-GTM (General Transport Model) Development Update

En-Ching Hsu, Engineer WR, DWR and Nicky Sandhu, Senior Engineer WR, DWR

DWR's Delta Modeling Section is developing a new DSM2 transport module, the General Transport Model (GTM). The mesh for GTM is fixed (Eulerian) rather than moving with flow (Lagrangian), and this should make it easier to interact with other models, georeferenced data and visualization as well as to couple to Hydro. The modularized design makes it possible to run either inline or offline with DSM2-Hydro. This will allow the gate operated based on the salinity standard.

The scope of GTM development is to apply the Eulerian scheme on delta network and have reasonable results by comparing to observed data and the results from DSM2-Qual. We use salinity for testing as there is more field data and calibrated model results for comparison. Once it produces reasonable results, we will move on to the further developments of DO module, sediment module and integration with mercury module

The milestones and completed tasks are listed as below.

1. Linkage to DSM2-Hydro

From April 2013, staff started to study the existing Eulerian transport code and tried to make the linkage to DSM2-Hydro. We discovered it necessary to modify DSM2-Hydro output tidefile so that it can be used for DSM2-GTM. The changes include:

(1) The output precision going from coarser node to finer computational points,

(2) Outputting instantaneous flow and water surface instead of the theta-averaged values,

(3) Only outputting flow and water surface and dropping out area which can be derived from water surface and channel geometry on the fly, and

(4) Printing out the lookup table of virtual cross section.

2. I/O System Design

Input System: We built an input system that has similar interface as DSM2-Qual. The idea is that users can use their existing Qual input file with minimum changes to run GTM. The input system takes specifications of grid size, time step, runtime period, parameters, boundary time series, corresponding file paths, boundary condition and initial conditions. Read in boundary conditions and DICU time series from HEC-DSS file, and assigned them to the corresponding locations and interpolated the value for the current time step.

Output System: We built an output system to store raw outputs in HDF5 format and users' specified outputs in HEC-DSS format. The specification includes locations, time intervals, and options of period average, min, max or instantaneous values.

DSM2-GTM (General Transport Model) Development Update – CONTINUED

The network stores the information of the cells and their properties if associated with boundaries, junctions, external flows and reservoir connections.

3. GTM Grid

GTM Grid: Generate the GTM network grid based on the specified grid size. The network stores the information of the cells and their properties if associated with boundaries, junctions, external flows and reservoir connections.

Interpolation: In order to feed the hydrodynamic data during runtime, a finer resolution of hydro data is needed. The interpolation is done by linear interpolating the water surface and area thus can be derived. The flow is obtained by satisfying conservation of mass marching forward in time. The hydro data source can be implemented by passing data from runtime memory or other formats.

4. Network Enhancements

One-Dimensional Eulerian Transport Module for Single Channel Network: UC Davis and DWR staff had developed a one-dimensional Advection-Diffusion-Reaction Eulerian transport scheme on a single channel. They had done unit tests and convergences tests for the algorithm with various synthetic flows to ensure there is no numerical dispersion for this transport scheme.

Varying Grid Size: One modification was done for the scheme is to allow varying dx, while the original scheme assumes uniform grid size. The changes were tested and they did not affect existing tests. The convergence test for varying dx case is passed with the second order accuracy.

Enhancements: To accommodate delta features, such as multiple boundaries, junctions, cells with non-sequential numbering, external flows and reservoirs, enhancements are built on top of the transport code. For advection calculation, gradients are recalculated for those features and the junction mixing is based on the mass coming into a junction and distributes the mixed concentration to the downstream. For diffusion calculation, we have to move from solving the equations from a simple tri-diagonal matrix to a much complicated sparse matrix. The formation of the sparse matrix is based on the actual connection among cells. The advanced sparse solver technique is very efficient and no noticeable slowdown is observed.

5. Full Delta Grid Simulation

Sub time stepping: To ensure CFL number is close to one for stability, sub time stepping is activated during the runtime.

Full Delta Grid Salinity Simulation: We tested delta full grid with historical EC setup. The setup includes all boundary flows, DICU flows, reservoirs, and gates. For most locations, it yields reasonable results comparing to observed data and DSM2-Qual.

The future developing plans are:

- To test GTM with more scenarios to catch bugs or problems before going to calibration,
- To improve the speed and profile the performance,
- To calibrate EC with historical data,
- To develop suspended sediment module and its interaction with bed sediment module,
- To develop DO module to simulate non-conservative constituents, such as temperature, dissolved oxygen, nitrate, BOD, etc, and
- To have GTM run in-line with DSM2-Hydro.

DSM2 Modeling for the 2015 Drought

Eli Ateljevich, Senior Engineer WR, DWR and Ming-Yen Tu, Engineer WR, DWR

During the 2015 drought, DSM2 was used to vet operational responses to low water supply, assess emergency barrier designs and analyze the impact of the West False River barrier.

Temporary Urgency Change Petition (TUCP)

As it did in 2014, DWR petitioned the State Water Resources Control Board for relaxation of standards in the Delta. The proposed changes under TUCP included: (1) a change in the minimum Net Delta Outflow Index specified in D-1461, (2) a change in the Sacramento River flow requirements at Rio Vista and (3) a change of D-1461 salinity compliance location from Emmaton to Threemile Slough. These changes were requested to allow management of reservoir releases that conserves upstream storage for fish and wildlife protection and Delta salinity control while providing critical water supply needs during the severe drought event in 2015. A key difference with last year was that operational scenarios largely assumed the installation of an emergency drought barrier at West False River. The modeling assumptions included forecasted hydrology (e.g. boundary inflows, Delta Cross Channel operations, exports and diversions), consumptive use in the Delta, and a proposed new barrier at West False River. DSM2 was used to assess the potential hydrodynamic and water quality changes in the Delta under TUCP conditions. Figure 1 shows an example of model outputs. Because the TUCP retained outflow standards in mid-late summer and only relaxed agricultural water quality standards only as far as Threemile Slough, those are the regulations that tend to be limiters. This is even more the case with the emergency drought barrier in place, which effectively cuts off the direct route for salinity intrusion into the mid-Delta. In DWR analyses, the overall water savings under the TUCP was found to be modest, but the improvement to water quality in the mid and south Delta was significant and this was thought to facilitate management of risk associated with water supply and its routing to the Delta.

DSM2 was used to assess the potential hydrodynamic and water quality changes in the Delta under TUCP conditions.

Analysis of Emergency Drought Barriers

The purpose of the emergency drought barrier (EDB) at West False River is to control saltwater intrusion into the Delta with reduced reservoir releases while continuing to meet federal and state regulatory requirements.

DSM2 Modeling for the 2015 Drought – CONTINUED

DWR studied the benefits of drought barriers in numerous locations using DSM2, eventually vetting three sites at Sutter Slough, Steamboat Slough and False River for final consideration.

Design

Over the course of two years, DWR studied the benefits of drought barriers in numerous locations using DSM2, eventually vetting three sites at Sutter Slough, Steamboat Slough and False River for final consideration. The barriers were studied in terms of potential water cost savings, risk reduction and impacts. The water cost analysis was calculated using the optimized water cost tool described in last year's annual report. In general, the water cost benefit from the barriers was expected to be minimal if the (relocated) Threemile Slough water standard or TUCP outflow became the limiter on operations. Despite limited projected water savings, salinity south of Franks Tract was expected to be much lower than it would otherwise be under the same hydrology and this was expected to be a critical hedge over uncertainty in water supply.

Biological Assessment

In addition to water quality benefits, a biological assessment (BA) was required to describe the effects of EDB on federally/state listed fish species. Under the same assumed hydrology conditions, DSM2 was used to assess the potential hydrodynamic changes in the Delta considering with- and without-barrier scenarios.

Responses to Stakeholder Concerns

DSM2 results were used to address various stakeholders' concerns due to the changes of Delta physical (or operational) conditions. For example, since the proposed new barrier is in the vicinity of Bradford Island, the Bradford Reclamation District 2059 was concerned about the potential changes on water quality. DSM2 results were used to analyze the potential effects of adding the new barrier, and demonstrated that the water quality changes at the locations of concern were not as serious as the District expected them to be.

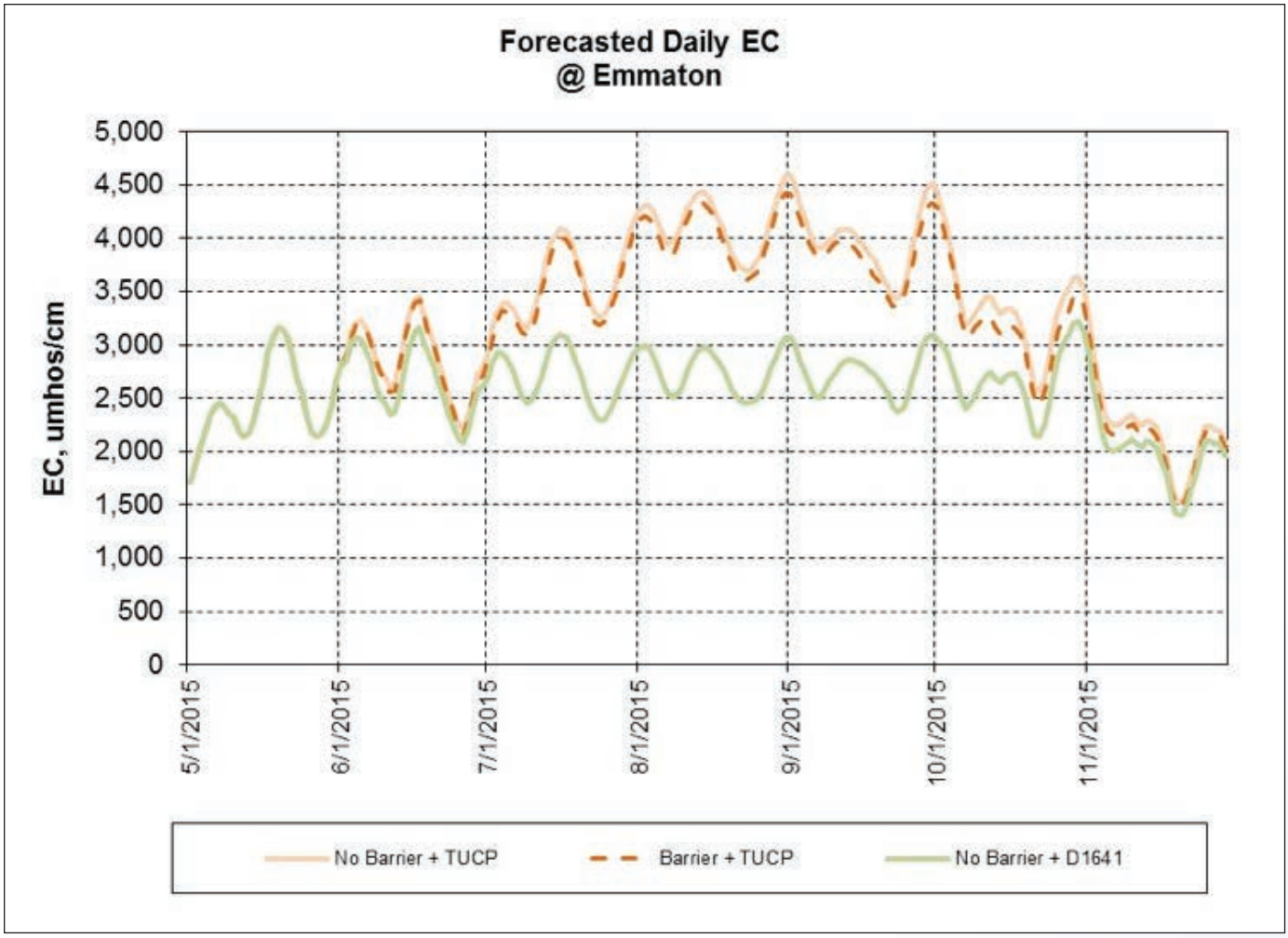


Figure 1 | DSM2 results for TUCP, where "D1641" refers to a reversion to the original outflow and water quality standards. Salinities are lower because of the Emmaton standard for EC.

DSM2 Application to Study Potential Without-Project Salinity Effects in the Delta

Chandra Chilmakuri, Water Resources Engineer, CH2M HILL

The purpose of this study was to analyze salinity conditions in the south Delta channels under a Without-Project scenario using the January 1, 2012 to August 31, 2015 hydrology.

This 2012 – 2015 DSM2 simulation allows understanding Delta salinity conditions for a sequence of differing hydrologic conditions under a scenario without CVP and SWP projects.

A DSM2 model capable of simulating 2012-2015 historical Delta hydrodynamics and salinity conditions obtained from the DWR was used for representing the With-Project scenario in this task. Adjusted 2012 - 2015 historic Sacramento River and San Joaquin River inflows to the Delta were provided by the State Water Contractors (SWC) were used as boundary conditions in the Without-Project Scenario. The adjustments included removing the impairments related to the upstream CVP – SWP reservoirs in addition to zeroing out the Delta exports at the Banks and Jones Pumping Plants. As an example, Figure 1 shows the Sacramento River Delta inflow assumed under the With- and Without-Project scenarios. In addition, the Delta Cross Channel was assumed to be closed, temporary agricultural barriers in the south Delta were not installed, and DICU and Martinez boundary conditions were unchanged. Vernalis EC boundary conditions for the Without-Project were modified based on an approach provided by the SWC. A more complete description of this study is included in the Attachment 5 of http://www.swc.org/images/stories/swc_complaint_june16.pdf.

The results show that due to a lower inflow at both Freeport and Vernalis during the summer and fall months under the Without-Project scenario combined with existing DICU diversions, salinity is much higher in the Delta compared to the With-Project conditions. During these months there is no fresh water to dilute the higher salinity intrusion, and as a result, higher salinity extends further upstream into the Delta under the Without-Project scenario. As an example, Figure 2 shows the contour plot of simulated DSM2 electrical conductivity in the Delta for 9th August 2014 for With-Project conditions (left) and Without-Project conditions (right). As shown in this example the saltwater-freshwater interface has moved much further inland in the Without-Project scenario than the With-Project conditions.

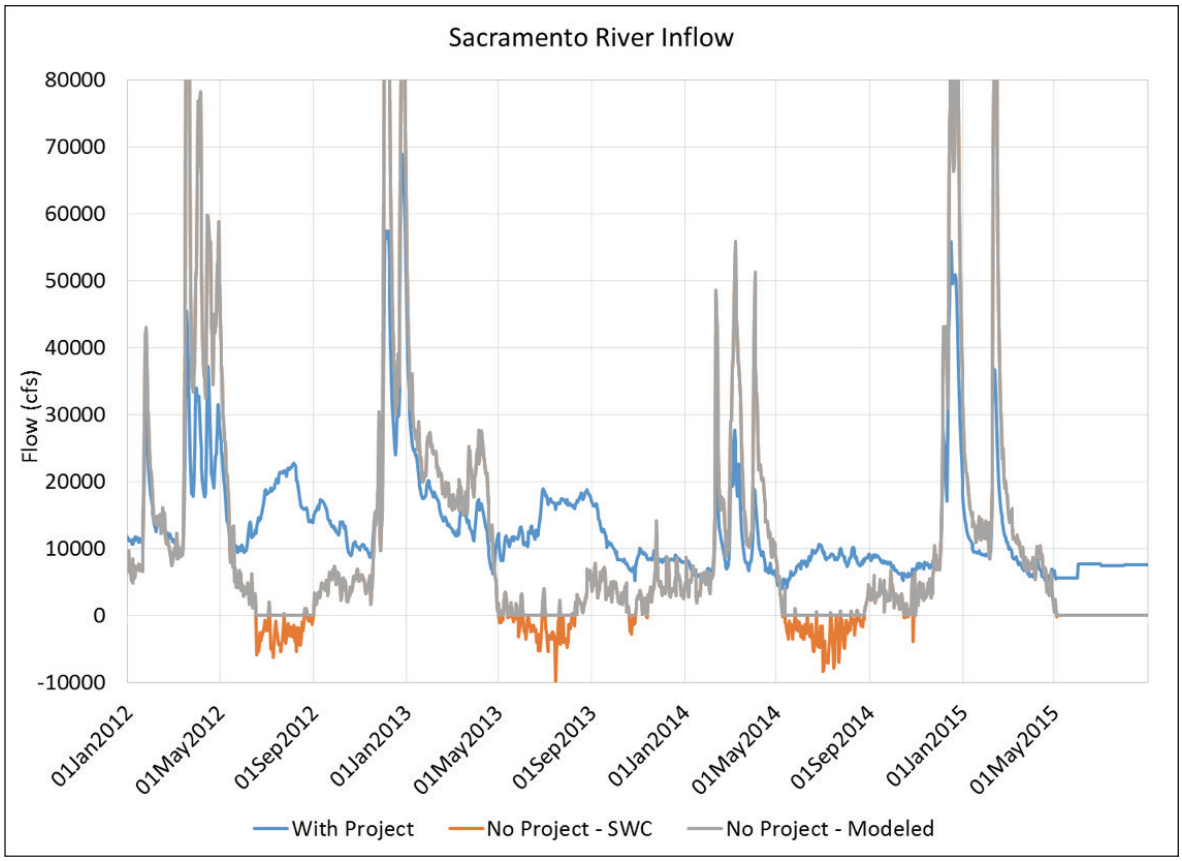


Figure 1
Sacramento River at Freeport DSM2 model inflow for 2012 to 2015

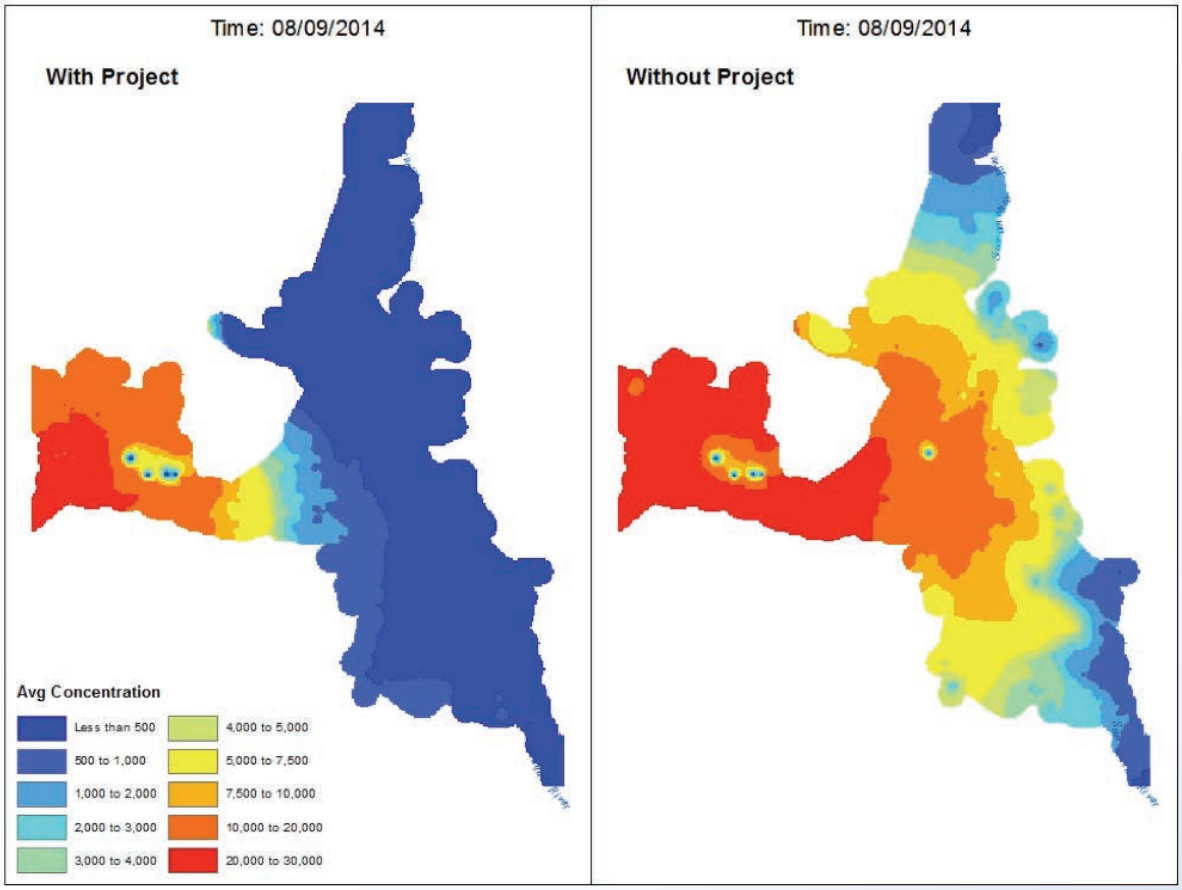


Figure 2
Contour plots of DSM2 electrical conductivity in the Delta for 9th August, 2014 for With-Project scenario (left) and Without-Project scenario (right)

DSM2UG people

Being a Kid, Raising Great Kids, Playing with Grandkids

Russ Brown
Technical Director,
Hydrology and Water Quality,
ICF International

I grew up in southern California, living in a tract house in Saugus (near Magic Mountain). The main road was San Francisquito Canyon, downstream from the infamous Saint Francis Dam (failed in 1928) and one of the LADWP hydropower plants along the LA Aqueduct. I hiked along the LA

Russ at home on his birthday this year with two of his youngest grandchildren.

aqueduct pipe on the ridge behind our house and watched giant pipe transport vehicles lay the pipeline from Castaic Lake to San Fernando Valley (for Delta water). So maybe that was why I ended up in water resources!

My family (four kids) would go to Knott's Berry Farm and Disneyland (I was 3 when it opened) each summer; my friends and I would build small versions of the caves, tree forts, railroad trestles, swinging bridges and water ponds, just like Tom Sawyer's Island. This was my first experience with scale models. My Dad helped me build an HO model railroad – it was mounted on ropes and pulleys from the ceiling so we could raise it to save space in our play room. This was my first experience with engineering.

My life through high school was completely normal except that I skipped 2nd grade (I can't spell) and 6th grade (I missed building a California Mission model). I learned to drive in my Dad's MGA (British sports car), and I drove off to college at UC Santa Cruz in my brown Mustang when I was just 16. I lived with my grandmother and worked summers at the Santa Cruz Lumber Company store, loading pickups. Each summer my family had visited my grandparent's cabin in Ben Lomond, playing along the creek and hiking in the redwoods. We now own half of my grandfather's land and often stay in my uncle's cabin and relax in our two-story deck (built inside a "redwood ring" with 12 trees), ride our 400-ft long zip line, hike along the logging roads (my kids ride dirt-bikes), or watch our grandkids play in the creek.

I transferred to UC Irvine because I was interested in civil and environmental engineering; so I switched

from being a "banana slug" to an "anteater". I was greatly influenced by watching the Undersea World of Jacque Cousteau, and thought I wanted to help protect our ocean resources. It was 1970, we had just landed on the Moon (and completed Clifton Court Forebay), but I thought I should study to become a steward (wise user and caretaker) of our most important natural resource – water. I used a side-rule for all of my homework, but there was a new thing in the computer-engineering department – a room full of terminals connected to the IBM mainframe. You could type lines of code and watch simple graphics. Most jobs were submitted on card decks and the results were printed on computer paper (no memory). I enjoyed living in the dorms at UC Irvine and met my future wife, Judy, at Christian student activities (Bible studies and worship groups).

I graduated in 1972 with a draft lottery number of 65- ready for Vietnam. But at my physical exam they found I had sugar in my urine (diabetes) and told me to see a doctor. I went to MIT for a Master's Degree in Ocean Engineering after all, to study breakwaters, submersibles and oil platforms; my research project was underwater welding (seriously) which was my introduction to heat transfer (I'm still working on water temperature models).

Judy and I were married in July 1974 in West Covina and our honeymoon was a month-long camping trip up the coast to Vancouver B.C. and across the country to Boston MA in a Volkswagen van. Judy and I began our married life as "advisors" in one of the undergraduate dorms at MIT, which had become co-ed for the first time; we went on many day-trips and dinner adventures around Boston with students and held study breaks every Tuesday

Five of Russ' grandkids with their new cowboy hats and boots last Christmas

DSM2UG *people*

Russ just landing after first ride on our 400-feet long zip-line in the Santa Cruz Redwoods

night. We travelled around the east coast to see the colonial and revolutionary war historical sites, sometimes with students. The van engine needed rebuilding, so I took out the engine and rebuilt it in the dorm hallway, with some help from the mechanical engineers. I had switched to water resources in Civil Engineering and worked on a research project evaluating the colonization rate of marine organisms on sampling plates within the thermal plume of Millstone nuclear power plant; I never knew what they might have done if there was an effect. This was my first research in coastal zone monitoring; I hoped I was following Jacques Cousteau to high adventure, but our analysis was done with punched cards and statistical indices.

My advisor thought I should try applying for a graduate research grant with the US Army Corps of Engineers at Waterways Experiment Station (hydraulic model laboratory) in Vicksburg, MS where he was a consultant on reservoir stratification projects. After finishing my courses, we moved in a station wagon with a trailer made from a pickup to Vicksburg, camping and visiting historic sites on the way. I was working with a group of people developing computer models (instead of hydraulic models) to study reservoirs, rivers and estuaries (places the USACE built things). I was applying their new reservoir models (CE-QUAL-1 and -2) to match water quality data from a reservoir in Iowa – was it more like a river or a lake? After a year we lived in Davis (HEC) for a month to learn to use the WQRRS model that HEC had developed as a combined reservoir-river model. We expected that every reservoir and every river in America would soon each have model, with data to provide the inputs and calibrate the coefficients; I am surprised that 40 years later we haven't quite finished this task. We moved back to write my thesis and lived in my advisor's Victorian house (fully restored) in Lexington for 6 months while he was on sabbatical in Vienna.

My first job after finishing my PhD in 1978 was at the Tennessee Valley Authority Engineering Laboratory in Norris TN, near Knoxville. This was in the town that had been constructed for the workers building Norris Dam starting in 1936; the stone houses for the married engineers still provide nice homes along the winding roads – what a beautiful place for the hydraulics lab. Several of us would run during lunch through the woods around town. My project was to analyze the hourly water temperature that were being collected in the reservoirs, upstream and downstream of the steam and nuclear power plant; we were monitoring the thermal effects on fish, and was developing hourly water temperature models and producing color graphs on an early HP color pen printer. I was part of the transition from hydraulic models and hand measurements to computer calculations and remote monitoring. I'm still working with hourly water temperature models and producing lots of color graphs. I was working on a simple 2-D box model for reservoirs (35 in TVA)- with the idea to show the measured data and the calculated flows, temperatures, DO, turbidity and algae together – always data plus model results.

This is still my basic approach, "work with data in the mornings and use models only in the afternoon".

We had our first son, Jeremy, in Vicksburg, and two more sons, Gabriel and Noah in Knoxville. We were fascinated with Victorian houses, and decided we would buy one to fix up while we lived in it with our small boys. So I had two jobs, temperatures and reservoir modeling in the day and patching lath and plaster walls, and wallpaper and painting at night. It was a giant two-story house with way too many things to repair; we never finished the remodeling, but moved to Cookeville to teach hydrology advise graduate students in water quality modeling at Tennessee Tech. I enjoyed my years there working with students on several research projects (reservoirs and water quality). Our daughter, Meadow, was born in Cookeville, and we had some happy years raising four kids in the wooded hills of Tennessee. I even had a pickup truck for a couple of years. We bought a big blue Dodge van to travel around in (before minivans) and we had several camping tips and summer vacations in our van. When we left Tennessee for Sacramento in 1989, we loaded two large U-Haul trucks and the van and drove with my parents help across the country again. We had enjoyed our years living and traveling in the east and south but we were very happy to return to California and our families (cousins to play with).

Our life in Sacramento has been great fun. We bought a house in Carmichael (out of the floodplain in the Arcade Creek watershed) and our kids went to Del Campo high school. During their school years our boys were in scouts, on baseball and soccer teams, while Meadow was in 4-H (horses) and in ballet dancing classes. We went to church as a family and Judy and I taught Sunday school classes when our kids were in school; Judy and I still teach classes at our church, but our kids are going to other churches. I particularly enjoy teaching about God's

Russ and Judy visiting Yosemite (Glacier Point) with half dome in background (just before it slipped)

DSM2UG *people*

creation- the beautiful and glorious natural world that isn't natural at all. As a hydrologist, one of my favorite passages in the Bible is found in Isaiah 55: 9-11 "For as the heavens are higher than the earth, so are my ways higher than your ways and my thoughts than your thoughts; and as the rain and the snow come down from heaven and do not return to it without watering the earth and making it bud and flourish so that it yields seed for the sower and bread for the eater, so is my word that goes forth from my mouth, it will not return to me empty but will accomplish what I desire and achieve the purpose for which I sent it." Our kids went to summer camp at Hume Lake in Kings Canyon National Park. Judy and I would often camp along the Kings River while our kids were at camp; we enjoyed walking along the river or through the Sequoia groves and meadows where John Muir once roamed. We have been to most of the western National Parks and scenic wonders in California. "Your Love O Lord reaches to the heavens, your faithfulness to the skies, your righteousness is like the mighty mountains, your justice like the great deep sea" Psalm 36:5-6.

I enjoy reading historical-fiction thrillers, with adventures in far-away places and long-ago events. Clive Cussler, for example, combines ocean adventures with historical and scientific stories. I also read lots of "boring" books about water development projects; I have recently read several books about the railroads, tunnels and dams in the Sierra Nevada, like the SCE Big Creek project on the San Joaquin, the Yosemite Railroad on the Merced, the Hetch-Hetchy railroad, tunnels and dam on the Tuolumne, and other dams and aqueducts on California Rivers. I am always ready to ride steam railroads. This summer we were in Yosemite (at Wawona) and rode on the Yosemite Mountain Sugar Pine railroad, and stayed at Shaver Lake and visited the Big Creek project reservoirs (they are almost empty); we even made it to Edison Lake (what a road).

We always have birthday parties for everyone in the family; since we have four kids with spouses and nine grandkids, and relatives nearby, I estimate that we have about 25 parties each year (usually pizza

Russ likes to ride on old steam railroads, like this lumber train near Yosemite

and always cake and ice cream). We have a list of about 10 different birthday songs that we always sing. We are likely to have a party every other weekend. We have a few other fun habits – we always go to the Strauss Festival in Elk Grove (open air dancing with orchestra); Meadow was in the Polka dancers group one year. And we always to the State Fair and often to the County Fair to see the animals, since we don't live on a farm but wish we did. I always get a corn on the cobb on a stick, and this year I bought a carved wooden sign that says "Delta Dreaming" for my office door. We often go up to South Lake Tahoe because Judy's sister lives there; we like visiting the historic sites and walking to different lakes and water falls and meadows (nothing too strenuous).

We have had some great trips in recent years. Our first trip with passports was to France for a three week trip after Meadow spent her junior year studying abroad in Paris. We were in Paris for a week and then traveled in a loop through parts of France and Switzerland in a rental car; this was really fun since Meadow could communicate and help navigate through the beautiful countryside. Our next big trip was to Brazzaville (Congo) to visit with our son Jeremy and his wife Sara and their first son, Peregrine. They had lived in France for a year learning French because that is the government language in the Republic of Congo. They work on a team that is helping local translators from five languages translate parts of the Bible. This includes writing these languages for the first time (alphabet, grammar, and dictionary) and checking that the basic meaning of the Bible stories and promises are accurately described in these languages. Jeremy's part is creating videos with the spoken and written words on a series of picture backgrounds; not quite movies,

Russ at an old bridge over a canal Lock in Amsterdam at the start of his River Cruise

but requiring lots of computer skills. The most likely media will be cell phone apps, since everyone in Africa has one. You can read more about this Bible translation project on their website: http://illuminatingtheword.com/

Visiting Brazzaville for two weeks with them was quite an experience; seeing a developing nation's capital was just like the TV news, with very poor people living in very primitive conditions. While there I helped Jeremy build an octagonal fort (two levels) and a swing frame for the kids living in their center (walled office and apartment buildings) – using a rotary saw to make some complex joints. We went with them to a small resort on the coast (Point Noir) where we were the only families staying – very relaxing, and Judy and I stopped in Paris for a week on the way home, since Air France is the major airline (one flight each day) to Brazzaville.

Two years ago we went on a two-week River Cruise from Amsterdam to Vienna, traveling to a new city

DSM2UG *people*

Russ with wife Judy and four kids and spouses and nine grandchildren- last year in Apple Hill

each night along the Rhine, Main, and Danube Rivers. This was a totally luxurious way to travel and I really enjoyed seeing these rivers and the locks and dams with hydropower generation and bridges and ports; these rivers really are packed with transport boats, barges and cruise boats. Each day there was another historic town to visit, and we spent 3 days in Amsterdam and 3 days in Vienna. What a perfect blend of hydraulic engineering and historical sites, music and exploration. To read and see more, look at my travel blog: riverroaming@blogspot.com.
Last year, for our fortieth anniversary, we returned to Boston and visited many of the historic colonial sites, ate seafood and Italian food and walked on the streets of Old Boston, and then drove up the coast of Maine and New Brunswick, across to Nova Scotia and Prince Edward Island, and to Quebec City and Montreal. We stayed in historic inns and old hotels, saw many interesting places, several historic villages (restored), and rode ferries and scenic boat tours in Quebec and Montreal. Travelling to historic sites and natural wonders (rivers) is certainly one of my favorite things to do.

But why would we travel when most of our grandkids live right here in Sacramento? This is definitely my favorite part of my life these last eight years. I enjoy playing with each of them, on the floor with wooden trains, cars or dolls. I like taking them on wagon rides around the neighborhood – how many kids can you fit into one wagon? We walk to the park and play on the swings and slides and climbing equipment. As the kids get older we have gone camping and hiking and ride the zip-line and play in our creek together. We have sleep-overs together; we had six of them over last month for one night. Being a grandpa is a lot easier than being a Dad or Mom – since you can send them home at night or when they get fussy. I love every moment I have with any of them – nine breathing air and at least one more coming soon.

I have always enjoyed attending technical meetings and workshops- in various cities around the country. When I was at TVA I regularly attended ASCE hydraulic engineering conferences – often travelling with my family and vacationing the week before or after. We also had annual meetings with TVA, USACE and USBR reservoir modeling groups. In California I have worked on Delta projects like Delta Wetlands or SDIP and have attended every IEP meeting since 1990 (at Asilomar or Lodi or Folsom) to learn more about the fish. And I have attended all of the CWEMF annual meetings and lots of workshops. I enjoy listening to what others are doing and considering new ideas or approaches to hydrology and water quality and fish habitat analysis. This is why I try to attend the DSM2 group meetings. Asking questions seems a natural way to learn more.

A PEEK INTO HOW HE OPERATES…

Q&As with Dan Yamanaka

Min Yu, Senior Engineer WR, DWR and Dan Yamanaka, Supervising Engineer WR, DWR

Dan Yamanaka, Chief of OCO's Delta Compliance and Modeling Section, has been with DWR for over 21 years. He has been participating in DSM2UG activities from the group's very beginning. A long-standing member of the group, he leads a team which plays in a critical role in DWR's daily operation forecasting.

When I first approached Dan about sharing his background with the DSM2UG, he turned me down flat. But through alternately pleading and begging, I think I wore him down until he agreed. Little did I know that Dan was actually very 'shy' about being interviewed :). To let us get to know him more, he suggested using a list of questions for which he would provide answers.

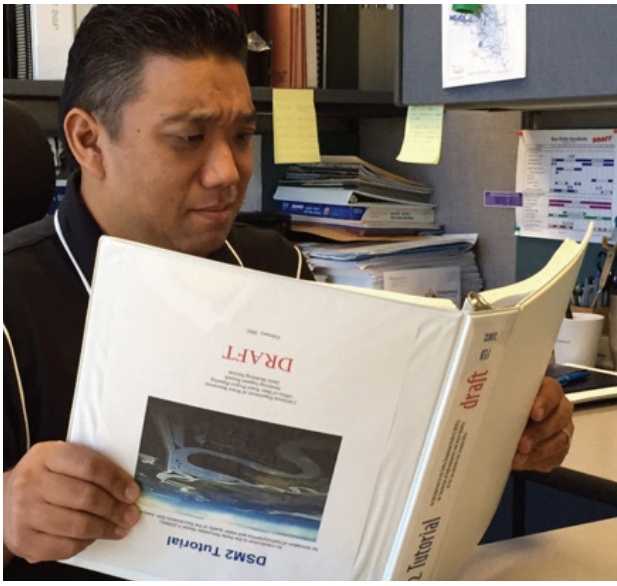
Here is what you can find out more about Dan:

1. **What is your education experience?**

I graduated from Cal Poly SLO with a BS in Civil Engineering.

2. **Would you please share your work experiences? When did you start with DWR?**

I began my career with DWR in March 1994 in (what was then called) Design & Construction on Phase II of the Coastal Project. This included working in the materials laboratory analyzing and evaluating construction materials and performing construction inspection of the installation of over 100 miles of pipeline and construction of three pumping plants and a large water storage tank site.



Here I am, digging into DSM2…

After this, I returned to Sacramento to work in the Delta Planning Branch of the Office of SWP Planning (what is now called Bay Delta Office) coordinating the installation and removal of the South Delta Temporary Barriers, which also included preparing and coordinating the completion of various permits and environmental documents. After working in the Delta Planning Branch for about a year and a half, I then moved

DSM2UG *people*

to the Division of Flood Management where I held a variety of positions and roles for a little over 13 years. These roles ranged from managing flood improvement projects to managing bond-funded programs, including Proposition 13's Yuba Feather Flood Protection Program and Propositions 1E and 84 general bond funds. My last job with Flood Management, before moving to SWP Operations, was as part of the managing team for the Floodplain Evaluation and Delineation Program established within FloodSAFE. This assignment included working with several consultants and federal/State agencies, including FEMA, USACE, and USGS, to ultimately develop updated floodplain maps established by modernized floodplain mapping models. These models were developed using several hydraulic models including Flo-2D and HEC-RAS.

Finally, in September 2010, I jumped at the chance to work in DWR's SWP Operations Control Office and get back to my roots of helping manage and maintain the Sacramento-San Joaquin Delta and work in a dynamic water environment where one day can be completely different from the next.

My family (me, my wife, Alyssa, Sarah) visiting our favorite place, the Happiest Place on Earth.

3. Any particular projects that you were most interested?

It's difficult to point to one particular project as being my favorite--I liked them all for different reasons and learned a lot from each one. I learned a lot about construction methods and practices in D&C. I learned a lot about the State Water Project and the Delta and how they work in Planning and more so in OCO. And I learned a lot about the Central Valley's flood control system and how to manage projects and programs in Flood Management.

4. How about your personal life if you don't mind sharing with us?

At the risk of continued ridicule from a larger group of my peers, I proudly announce that I live in the Greenhaven/Pocket area of Sacramento. Yes, I know it's a deep floodplain and I'm totally at risk for losing my home and all my possessions, but that's where I grew up and where most of my family are. I'm married to my high school sweetheart, Michelle, who has put up with me for 30 years (20 of them legally married to me). We have two smart, beautiful daughters, Sarah (15) and Alyssa (12), who bring me joy and pain every day.

5. Do you have any hobbies?

Although I don't get to enjoy it as often as I'd like, my longest-lasting hobby is playing golf. I enjoy the challenges of golf, both individually and against others of similar caliber. I also enjoy watching movies, old and new. More recently, I've developed an interest in running, more specifically running half marathons. Over the past year, I've run two half marathons and several 10k/5k races. My most recent half marathon was in early September at Disneyland, specifically the 10th Anniversary of its half marathon. I haven't scheduled my next one yet, but whatever it is I hope to better my run time.

6. What do you believe in life?

My motto in life is "Things happen for a reason, even if it doesn't reveal itself immediately." There have been many events in my life that seemed negative while they were occurring, but ultimately led to events that enhanced or improved my life. Whether this says that I believe in fate or not is still up for debate. In the meantime, I recently came across an article that touched me and somewhat explains how I'd like to live my life:

"Live simply.

Love generously.

Care deeply. Speak kindly.

Remember, if a dog was the teacher you would learn things like:

- *When loved ones come home, always run to greet them.*
- *Never pass up the opportunity to go for a joyride.*
- *Allow the experience of fresh air and the wind in your face to be pure ecstasy.*
- *Take naps.*
- *Stretch before rising.*
- *Run, romp, and play daily.*
- *Thrive on attention and let people touch you.*
- *Avoid biting when a simple growl will do.*
- *On warm days, stop to lie on your back on the grass.*
- *On hot days, drink lots of water and lie under a shady tree.*
- *When you're happy, dance around and wag your entire body.*
- *Delight in the simple joy of a long walk.*
- *Be loyal.*
- *Never pretend to be something you're not.*
- *If what you want lies buried, dig until you find it.*
- *When someone is having a bad day, be silent, sit close by and nuzzle them gently."*

— Author Unknown

7. What did make you choose engineering/ engineer as your career?

Y'know. I'm not really sure. I recall talking to my dad, who was an auditor for the State of CA, and him saying that he would've liked to have been an engineer. That, paired with my penchant for math and sciences, led me to engineering, and that's what ultimately stuck.

8. Are there any long term goals – what would you like to be doing 5 years from now?

Long-term goals? Retire with enough health and money to really enjoy it. I wish I could say that would only take 5 years to accomplish, but with two kids not even in college yet I think that's going to be a longshot.

My daughters and me in summer 2013 in Hawaii, when we hiked to the top of Diamond Head Crater.

DSM2UG people

Dreams Do Come True

SUBIR SAHA'S STORY

Min Yu, Senior Engineer WR, DWR

If you have been in the Delta Modeling community for the last 5 years, and/or if you have been keeping up with the Bay Delta Conservation Plan project, you would probably have gotten to know Subir Saha well. Subir has been one of the key modelers in the Delta Modeling Section (DMS) and a major player on the modeling team for the BDCP project.

Subir is from Bangladesh. He earned a Bachelor of Science Degree in Civil Engineering in 1997 from Bangladesh University of Engineering and Technology, specializing in Environmental Engineering. After graduating, Subir worked for a year as an engineer at the Institute of Water Modelling in Bangladesh. His main responsibility was to develop a MIKE 11-based model for an irrigation canal and perform data analysis and calibration.

In 1999, Subir relocated to Singapore and worked as a Research Scholar for two years in the Department of Civil Engineering at National University of Singapore. His expertise in modeling allowed him to further expand his skills by simulating Zooplankton and Phytoplankton kinetics in the coastal waters of Singapore. During this time Subir also developed an algorithm for solving partial differential equations using Finite Difference schemes and implemented it in Digital Visual Fortran.

Subir came to the States in 2001 to further his education. He attended Rutgers, The State University of New Jersey, pursuing his Master of Science Degree in Civil & Environmental Engineering, specializing in Environmental Engineering. Subir earned his MSCE degree and further adventured into the modeling field by working as a Project Engineer at HDR|HydroQual, a consulting firm in New Jersey. During his six years at Hydroqual, Subir worked on a variety of modeling projects. His main responsibilities included analysis of constituent concentrations measured in water columns and/or sediment of various waterbodies, development and application of a variety of modeling tools to analyze conventional pollutants in waterbodies, fate and transport of toxic substances in sediment and waterbodies, eutrophication in waterbodies, hydrology, and sewer-system flows. He was also the lead person and supervised junior staff on a number of assignments before leaving the company in 2008.

I was curious about why Subir uprooted his family to move to California back in 2008. He 'confessed'

Emerald Bay, Lake Tahoe, California in December 2009

that he was in fact ready to explore more career opportunities on the West Coast after his buddie Nazrul Islam (a Senior Engineer with DWR's CalSim modeling group) landed a job with DWR. In fact, after communicating frequently with Nazrul, Subir became fascinated with California's water systems and he believed that his modeling background would be an ideal fit for the Modeling Support Branch of DWR. It just happened there was a position available in the Delta Modeling Section in time which Subir aced the interview with flying colors and came on board in 2008.

When I asked Subir about his first impression after joining state service, he chuckled and mentioned that the very first thing he noticed was the dress code. He came to work on his first day in a suit and tie, and found he was surrounded by his new peers who were in polo shirts and khakis or wore dress shirts with jeans. He recalled that he felt way too overdressed and a bit 'embarrassed'. It didn't take long for Subir to embrace this new casual business attire (comparing with his old days at a consulting firm), while he drew back on his modeling experiences and acclimated himself to the new job at DMS.

What has been most appealing and satisfying to Subir since he became part of the DMS family are the projects he has worked on. Starting with the DSM2 Database development and application, Subir has had many opportunities to work on some of the most exciting assignments the past several years. In addition to being a key modeler on the BDCP project, other highlights of Subir's career so far include providing technical support to the State Attorney for Jones Tract litigation, conducting flood analysis of the 2-Gates project, and modeling studies for the Drought Emergency Barriers. Recently, Subir again was chosen to work on 'California Water Fix', which is a trimmed-down version of BDCP. Subir has been working on analyses of model data from alternatives to evaluate impacts on DWR's contract agreement with different stakeholders.

DSM2UG *people*

Subir has never ceased to improve himself during his seven years with DWR. He revealed that he was one of the lucky participants of the 2011 Water Leaders Class sponsored by the Water Education Foundation. His mentor during the class was the elected Director of Contra Costa Water District, whom he shadowed for a day and also interviewed for his class final presentation.

In his personal life beyond modeling, Subir enjoys traveling, loves day hikes and beaches. Subir and his family have lived in Folsom for six years and they love the community very much. What Subir is most fond of is his quality time with his 3 year-old boy Shopneil. As claimed by the loving father Subir, Shopneil is actually his boss who gets to decide what to do or play.

Looking forward, Subir is ready to take up new challenges to expand his horizons. He is thrilled to be able to follow his passion in computer modeling, and has achieved his dreams in both his work and family life. Subir hopes that he will continue to work on projects that will make a difference in California water. He also aspires to be able to advance his career to the next step which requires the perfect blend of his technical modeling skills with management and leadership abilities.

Multnomah Falls,
Oregon in May 2013

ASK A MODELER

IF YOU HAVE THE QUESTIONS,

WE HAVE THE ANSWERS!

Q: **The latest DSM2 download has dicu_wq dss file that goes to 2020 but the flow file stops at 2003. Where can I find the flow file for recent years?**
(Dr. William Fleenor, Civil & Environmental Engineering Department, UC Davis)

A: The flow data is available for downloads at https://dsm2ug.water.ca.gov/documents/18/84011/dicu_201506.dss
Answer provided by Min Yu, Senior Engineer WR, DWR

Q: **Can you provide an updated and extended hydrology dataset for the SWP, covering 1922-2012?**
(Maria T. Lopez, Engineering Compliance Team, Metropolitan Water District of Southern California))

A: For planning studies, CalSim model data only goes to 2003. It seems like you may want SWP operations data which I think you can get from CDEC or Dayflow.
Answer provided by Erik Reyes, Supervising Engineer WR, DWR

Q: **I have been looking through the DSM2 model and I have been trying to understand the operation of the temporary south delta gates. I have been able to find the op rules for the different gates, but I have not been able to find the input file that says when the different op rules will be implemented. Could you please let me know where I could find that. Thanks in advance.**
(Thomas Burke, P.E., Principal, Hydrologic Systems)

A: We have a baseline echo file for a DSM2 planning study (Existing Condition) and a DSM2 historical simulation input file for the operation rules of the south Delta temporary barriers. Both files are available online at our DSM2UG portal under Library/Gates Files (URL: https://dsm2ug.water.ca.gov/library/-/document_library/view/252090).
Answer provided by Lan Liang, Engineer WR, DWR

in MEMORIAM

Retired Principal Engineer George Barnes, who was instrumental in creating the Modeling Support Branch of the Bay-Delta Office, passed away at the age of 74 on March 31, 2015.

Francis Chung, Principal Engineer WR, Chief of Modeling Support Branch, DWR

During his 39 years of DWR service, he started working for the Division of Planning (roughly a combination of one office and two divisions today – the Bay-Delta Office, the Division of Statewide Integrated Water Management, and the Division of Integrated Regional Water Management) until his retirement in 2000. Starting as an engineering aid II and later water resources technician, George realized the importance of collecting reliable field data and facilitated several field campaigns to improve and update the field data collection and compilation effort in the department.

He was a visionary always looking beyond the current frame and visualizing and strategizing the future. At the same time, he was a classic example of a realistic and pragmatic engineer focusing on solving the current challenges, issues and problems. This dual focus made him an ideal leader for the Modeling Support Branch whose duties include the application of the existing tools to develop insights and explore solution options for the present day problems and the development of devices that can prepare us to tackle anticipated future issues and problems.

George's emphasis on people was legendary. He would say, "Good talents do not grow on trees." He respected people with talents, gave freedom to them to explore, perhaps most importantly allowed them

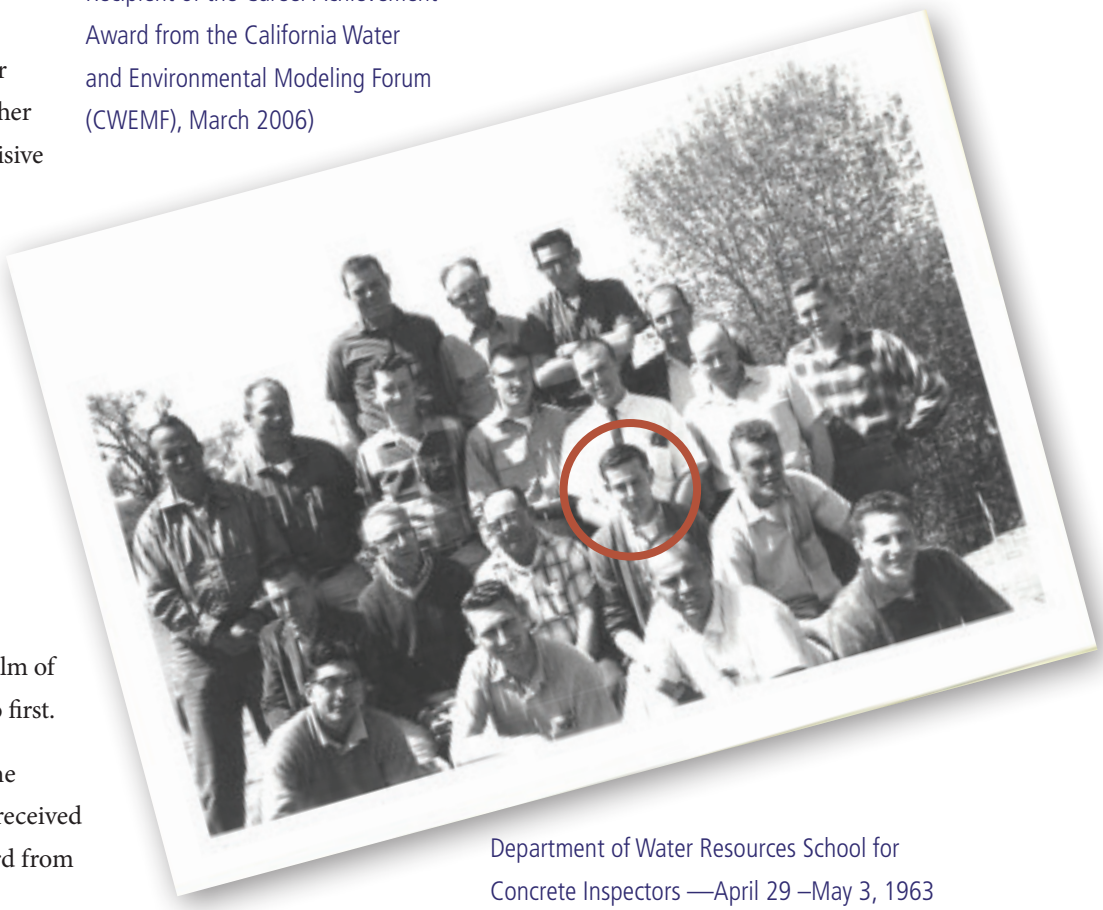
George Barnes

to fail and learn from the failure. Though it took a little while and some good faith effort, but once earned, he entrusted his people with firm support and freedom to explore. He was impatient with stagnations and was always on the move for the better solutions and new approaches. He was brave and not afraid of new challenges or high barriers whether they be technical, personnel, or financial.

George was aggressive with bringing talents into the DWR. He hired good engineers and scientists not only from all over the California but also from other states. He was creative and decisive with personnel transactions to the point of somewhat confounding or perplexing to the DWR HR division staff. He was active and effective in garnering the management support and securing necessary budgets and positions to carry out his goals. He firmly believed in people; his motto was "people make the difference." In his realm of management, people always go first.

For his contribution toward the modeling profession, George received the Career Achievement Award from the California Water and Environmental Modeling Forum. "We lost a good friend," said Gary Bardini, DWR Deputy Director. "I've always appreciated George's vision and capabilities. We all represent some part of his legacy in water management." George was generous, kind, wise and is deeply missed. George is survived by his wife Molly, his daughters Julie and Lisa, three grandchildren, stepson David and one step grandchild.

Recipient of the Career Achievement Award from the California Water and Environmental Modeling Forum (CWEMF), March 2006)



Department of Water Resources School for Concrete Inspectors —April 29 –May 3, 1963

If you have any questions or comments regarding this issue of the Newsletter, please contact the facilitator of the DSM2 User Group:

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This newsletter can be accessed at the DSM2 User Group website:

http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/dsm2usersgroup.cfm